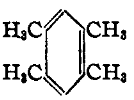
[CONTRIBUTION FROM THE SCHOOL OF CHEMISTRY OF THE UNIVERSITY OF MINNESOTA]

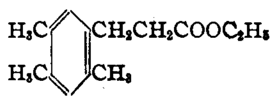
The Addition of Ethyl Diazoacetate to Prehnitene[1]

BY LEE IRVIN SMITH AND COURTLAND L. AGRE[2]

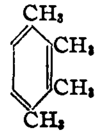
In a previous paper, Smith and Tawney[3] showed that ethyl diazoacetate, when heated with excess durene (I) formed an oil from which ethyl 2,4,5-trimethylhydrocinnamate (II) could be isolated in 30% yield. The remainder of the product was a tarry oil from which it was not possible to separate any pure materials, except in one case when a small amount of an impure amide, regarded as a cycloheptatriene derivative, was isolated after the oil had been subjected to the action of ammonia. The failure to isolate products intermediate between I and II was not surprising, since it is impossible for the diazo ester to add to any of the double bonds in I without the production of a primary compound containing a quaternary carbon atom. In the earlier study, a few preliminary experiments were made in which ethyl diazoacetate was added to prehnitene (III). One of the products was an oil which boiled at 131–135° under 5 mm. which, when saponified, yielded a crystalline acid melting at 142.5–143.5°. This acid was regarded by Tawney[4] as 2,3,4-trimethyldihydrocinnamic acid (IV), although the structure was not established by synthesis.



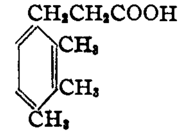
I



II

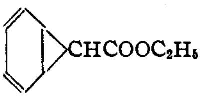


III

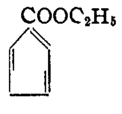


IV

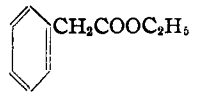
As a result of the work of Buchner[5] four types of isomeric compounds have been isolated from the products resulting when aromatic hydrocarbons and ethyl diazoacetate interact. These are norcaradienes (A), cycloheptatrienes (B), phenylacetic acid derivatives (C), and dihydrocinnamic acid derivatives (D) (when methyl groups are present in the hydrocarbon).



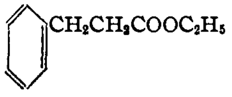
A



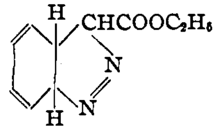
B



C



D



E

In only one case, however—that of *p*-xylene—have all four of these types been isolated from the reaction product derived from a single hydrocarbon. Moreover, since aliphatic diazo compounds usually react with carbon–carbon multiple bonds to give pyrazoles and pyrazolines, it seemed likely that the first product of the reaction between an aromatic hydrocarbon and ethyl diazoacetate might be an unstable indazoline (E).

The preliminary experiments of Tawney upon the reaction between prehnitene and ethyl diazoacetate indicated that the use of this hydrocarbon with the unsubstituted 1,2-position, might be particularly favorable for the isolation of intermediate products, as well as the full series of secondary products, and the study reported in this paper deals with a further investigation of this reaction.

When ethyl diazoacetate was added slowly to excess prehnitene at 140°, a steady stream of nitrogen was produced and the yellow reaction mixture gradually became orange. After removal of the excess hydrocarbon, there remained a rather viscous oil which by fractional distillation *in vacuo*, was separated into two parts. The higher boiling fraction, when hydrolyzed, gave a solid acid which was evidently a benzene derivative since it was inert toward permanganate and gave no color reaction with sulfuric acid. In analogy with the work on durene[3] this acid was assumed to be 2,3,4-trimethyldihydrocinnamic acid (IV) and a synthesis of IV proved this surmise to be correct.

The lower boiling fraction from the condensa-

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[1] Polymethylbenzenes. XX. Paper XIX, *J. Org. Chem.*, 2, 112 (1937).

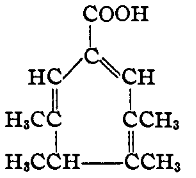
[2] Abstracted from a thesis by Courtland LeVerne Agre, submitted to the Graduate School of the University of Minnesota, in partial fulfilment of the requirements for the degree of Doctor of Philosophy, October, 1937.

[3] Smith and Tawney, THIS JOURNAL, 56, 2167 (1934).

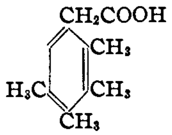
[4] P. O. Tawney, M. S. Thesis, University of Minnesota, 1934, p. 25.

[5] Buchner, *et al.*, (a) *Ann.*, 358, 1 (1907); (b) *ibid.*, 377, 259 (1910); (c) *Ber.*, 53, 865 (1920), and previous papers.

tion was a yellow liquid, giving, when saponified, a yellow oily acid which immediately reduced permanganate and which, with sulfuric acid, gave a bright yellow color. This color reaction was discovered by Buchner to be specific, among the possible condensation products, for the cycloheptatriene derivatives of type B. From this oily acid it was possible to isolate a yellow crystalline solid melting at 170–173°, which also reduced permanganate and gave the color test with sulfuric acid. Although the structure of this acid was not definitely established, it is represented as V, 3,4,5,6-tetramethyl-Δ-1,3,6-cycloheptatriene-carboxylic acid-1. Buchner had found that in the cycloheptatriene derivatives produced in this way, the carboxyl group was always as far from any methyl groups as possible; consequently the methyl groups were assigned positions 3, 4, 5 and 6. Four 3,4,5,6-tetramethylcycloheptatriene acids are possible, depending upon the location of the three double bonds, and structure V was chosen for the solid acid because the 1,3,6-positions for the double bonds correspond to the positions found by Buchner to be most likely in the case of the cycloheptatriene which he obtained from *m*-xylene. But the greater part of the saponified product was a viscous oil which could not be obtained crystalline and it is quite likely that it was a mixture composed of two or more cycloheptatriene acids differing in the positions of the double bonds. The liquid acid was converted into the amide, but this was also an oil although it, too, reduced permanganate at once and gave a bright yellow color with sulfuric acid.



V



VI

When the liquid cycloheptatriene acid was subjected to the action of hydrobromic acid in acetic acid, it gave a good yield of a crystalline isomeric acid which was found to be 2,3,4,5-tetramethylphenylacetic acid, VI, identical with the acid of this structure synthesized by Tawney[4] (see also experimental part of this paper). Such an isomerization has been shown by Buchner to be characteristic of many of the cycloheptatriene acids obtained by him.

No norcaradiene derivative (type A) nor indazoline (type E) could be isolated from any of the products obtained when the condensation between prehnitene and the diazo ester was carried out in the usual way. In the hope of obtaining these derivatives, the condensation was carried out at 140° for a much shorter time, and at lower temperatures for a longer time. The first of these procedures gave only a small amount of acid material, from which no solid could be obtained, but the yellow oily acid gave a bright red color with sulfuric acid, a behavior which Buchner had found to be characteristic of his norcaradiene acids. The second of these procedures—heating at 80° for eight days—gave essentially the same results as were obtained when the condensation was carried out in the regular manner, but when the condensation was carried out at room temperature over a period of several weeks, there was obtained a small amount of liquid product which contained nitrogen and which when heated to 120° decomposed with evolution of a gas. The amounts of material obtained in this experiment were so small that none of the products could be characterized. But the experiments indicated that the condensation did not proceed with any appreciable velocity at temperatures below which the indazolines (E) or the norcaradienes (A) were stable. The rapid evolution of nitrogen which occurred when the condensation was carried out at 140° showed that the indazoline was decomposing as fast as it formed, although the amount of nitrogen never exceeded 70% of the theoretical. The same is probably true of the norcaradiene, and it is noteworthy that when more than two methyl groups are present in the hydrocarbon, no norcaradiene has been found among the condensation products. Thus the norcaradiene has been isolated from the products obtained from benzene, toluene, *m*- and *p*-xylene, but not from the products derived from mesitylene, durene, or prehnitene. The indazolines must be even less stable, for no representative of this class has ever been isolated from the product of the condensation between an aromatic hydrocarbon and diazoacetic ester.

Experimental Part[6]

Ethyl diazoacetate was prepared essentially as described in the previous paper[3] (p. 2168).

Action of Ethyl Diazoacetate upon Prehnitene: High Temperature Condensation.—Prehnitene (125 g., dried

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[6] Most of the microanalyses by J. W. Opie.

over sodium and distilled; b. p. 113–115° at 55 mm.) was placed in a flask equipped with a dropping funnel, a thermometer and a condenser, so arranged that the exit gases could be led off through the condenser to a calibrated receiver. The flask, immersed in a sand-bath, was heated until the liquid was at 140° and then, over a period of five hours, ethyl diazoacetate (25 g.) was dropped in slowly. During the first half hour, evolution of nitrogen was rather slow, but after that a steady stream of gas was evolved. The reaction mixture was maintained at 140° after all the ester was added until the evolution of gas had practically ceased (three hours). Excess prehnitene and unchanged ester were removed from the orange liquid by distillation *in vacuo*, and the residue, a viscous red oil (27 g.) was fractionated *in vacuo*. From 40 g. of product, the following fractions were obtained (pressure, 3.5 mm.): (a) a forerun (13.4 g.) boiling up to 120°, which consisted chiefly of prehnitene; (b) a light yellow liquid (8 g.) boiling at 123–129°; (c) a yellow liquid (4 g.) boiling at 131–138°; (d) a viscous dark residue (7 g.) remaining in the flask. Redistillation did not lead to any fractions with narrower boiling point ranges.

Hydrolysis of Fraction c: 2,3,4-Trimethyldihydrocinnamic Acid (IV).—Fraction c (1 g.) was refluxed for two hours with a solution of potassium hydroxide (0.5 g.) in methanol (10 cc.). The methanol was removed under reduced pressure and the residue was taken up in water. The solution was acidified with dilute sulfuric acid, and then just enough alkali was added to redissolve the precipitate. After extraction with ether, the aqueous layer was evaporated to 5 cc., cooled and the precipitated potassium sulfate was removed. The filtrate was diluted to 10 cc., carefully acidified, and extracted thoroughly with ether. The ether extracts were washed with water and dried over sodium sulfate. Evaporation of the ether left a yellow oil which solidified when cooled and rubbed with petroleum ether. When crystallized from dilute alcohol the product (100 mg.) was white and melted at 143°. The substance was inert toward permanganate and gave no color reaction with sulfuric acid. It was identified as 2,3,4-trimethyldihydrocinnamic acid (IV) by comparison with a synthetic specimen.

Anal. Calcd. for $C_{12}H_{16}O_2$: C, 75.00; H, 8.39. Found: C, 74.95; H, 8.57.

Hydrolysis of Fraction b: 3,4,5,6-Tetramethyl-Δ-1,3,6-cycloheptatriene-carboxylic Acid (V).—Fraction b (5 g.) was refluxed for five hours with a solution of potassium hydroxide (4 g.) in methanol (25 cc.). The methanol was removed, the residue was dissolved in water and thoroughly extracted with ether. The aqueous layer was acidified and again extracted with ether. After drying the ethereal solution, the solvent was removed and the residual oil solidified when it was cooled and rubbed with petroleum ether. When recrystallized, twice from dilute alcohol and once from petroleum ether, the product was yellow and melted at 168–170°. The acid gave a yellow color with sulfuric acid and reduced permanganate immediately.

Anal. Calcd. for $C_{12}H_{16}O_2$: C, 75.00; H, 8.39. Found: C, 74.90; H, 8.36.

A small amount of fraction b was shaken for two days with concd. ammonia. No solid amide precipitated and the solution, after removing the unchanged ester, contained only a small amount of a dark, viscous oil from which no pure product could be obtained.

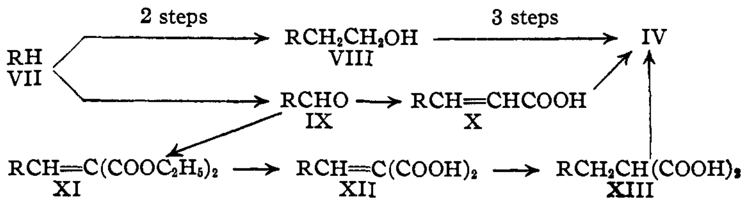
2,3,4,5-Tetramethylphenylacetic Acid (VI).—The crude oily cycloheptatriene acid (2 g.) from fraction b was dissolved in acetic acid (5 cc.) and the solution was saturated with hydrogen bromide and allowed to stand for two days at room temperature. The mixture was poured into water and extracted with ether. The ether layer was washed with water and dried over sodium sulfate. Evaporation of the solvent left a brown oil which solidified when cooled. The product, crystallized from dilute acetic acid (charcoal) formed white needles which melted at 159–161° and was identical with a specimen of VI prepared in another manner by Tawney.

Low Temperature Condensation.—Prehnitene (75 g.) and ethyl diazoacetate (16 g.) were allowed to stand at room temperature for thirty-two days. The unchanged reactants were removed from the yellow mixture by distillation under a pressure of 2 mm. The liquid boiled at 40–64°, and the highest temperature of the bath during the distillation was 75°. There remained a brown oil (1.8 g.) which reacted immediately with permanganate and which, with sulfuric acid, gave a red color with rapid evolution of a gas. No homogeneous product could be obtained from this oil. It did not form a picrate, and gave no solid derivative with either methyl iodide or acetyl chloride. When heated, the oil evolved a gas at about 125° but no homogeneous material could be obtained from the product. Saponification of the oil produced only a small amount of oily material which gave a yellow color with sulfuric acid but from which no solid product could be obtained.

A similar condensation of prehnitene (93 g.) and the diazo ester (19.4 g.) was carried out at 70–80° for seven days. After removal of the excess hydrocarbon, the red residue (19 g.), which gave a red solution in sulfuric acid, was distilled in a high vacuum apparatus. A light yellow distillate (4 g.) and a residue (11 g.) were obtained. From the distillate, 2,3,4-trimethyldihydrocinnamic acid (IV) was isolated. There was no evidence of the presence of either an indazoline or a norcaradiene derivative.

Many other condensations were carried out, under a variety of conditions, but the only solids ever isolated from the products were the hydrocinnamic acid (IV) and the cycloheptatriene acid (V). None of the distilled reaction products ever gave any solid (amide of the norcaradiene acid) with aqueous ammonia, nor did any of them give any solid derivatives with methyl iodide or acetyl chloride (indazolines).

Synthesis of 2,3,4-Trimethyldihydrocinnamic Acid (IV).—The route to this acid was as follows (R = 2,3,4-trimethylphenyl)



2,3,4-Trimethylbenzylcarbinol. (VIII).—4-Bromohemimellithene (11.2 g.)[7] and ethyl bromide (5.9 g.) were dissolved in ether (60 cc.) and slowly dropped onto magnesium (4 g.). To the Grignard reagent prepared in this way was added ethylene oxide (9 g.) in ether (15 cc.). After standing overnight, the product was isolated in the usual way. It boiled at 142–145° under 9 mm., but it was very difficult to remove traces of butyl alcohol and other by-products from the carbinol and good carbon and hydrogen values could not be obtained. The 3,5-dinitrobenzoate melted at 164–165°, and the *phenylurethan* melted at 127–128°. The latter was analyzed.

Anal. Calcd. for $C_{18}H_{21}O_2N$: C, 76.32; H, 7.42. Found: C, 76.34; H, 7.27.

β-(2,3,4-Trimethyl-phenyl)-ethyl bromide was prepared from the carbinol (4.5 g.) by heating it in a sealed tube at 100° for a day with acetic acid (40 cc.) saturated with hydrogen bromide. The bromide boiled at 138–141° under 10 mm.

Anal. Calcd. for $C_{11}H_{15}Br$: C, 58.15; H, 6.68. Found: C, 57.93; H, 6.64.

2,3,4-Trimethyldihydrocinnamonitrile.—The bromide (2.5 g.), sodium cyanide (3 g.), alcohol (7 cc.) and water (7 cc.) were heated for four hours on the steam-bath. The product boiled at 159–163° under 13 mm. and the distillate solidified. When crystallized from alcohol, the substance melted at 63°.

Anal. Calcd. for $C_{12}H_{15}N$: C, 83.20; H, 8.66. Found: C, 81.78; H, 8.59.

The nitrile (1 g.) was saponified by warming it with 1:1 sulfuric acid (10 cc.) for five hours on the steam-bath. The product was the acid IV, m. p. and mixed m. p. 142–144°.

2,3,4-Trimethylbenzaldehyde (IX).—Hemimellithene VII (18.3 g.), zinc cyanide (36 g.) and benzene (90 cc., thiophene free) were placed in a flask at 6–10° and dry hydrogen chloride was passed through the mixture for two hours. Then aluminum chloride (36 g.) was added and the temperature was kept at 50° for five hours while the mixture was stirred and a continuous stream of hydrogen chloride was passed through. After standing overnight the product was isolated in the usual way. It formed a water-white liquid which boiled at 121.5° under 11 mm. and melted at 7–8°. The yield was 15 g. (66%).

Anal. Calcd. for $C_{10}H_{12}O$: C, 81.00; H, 8.10. Found: C, 80.85; H, 8.08.

The oxime, prepared in the usual way and crystallized from dilute alcohol, melted at 131–132°.

Ethyl 2,3,4-Trimethylbenzalmalonate (XI).—The aldehyde (3.6 g.), ethyl malonate (4.0 g.) and piperidine (10 drops) were placed in a flask equipped with a drying tube and the mixture was heated on the steam-bath for a day during which a few more drops of piperidine were added from time to time. The product, crystallized from dilute alcohol, melted at 76–77°.

Anal. Calcd. for $C_{17}H_{22}O_4$: C, 70.34; H, 7.58. Found: C, 70.10; H, 7.59.

2,3,4-Trimethylbenzalmalonic acid (XII) was obtained by refluxing the ester with 15% aqueous potassium hydroxide solution for seven hours. The yellow solid was crystallized from dilute alcohol (charcoal). It melted at 196–197°.

Anal. Calcd. for $C_{13}H_{14}O_4$: C, 66.67; H, 5.98. Found: C, 67.46; H, 6.26.

2,3,4-Trimethylbenzylmalonic Acid (XIII) was obtained by reducing acid XII in alcohol with hydrogen under 35 pounds (2.3 atm.) pressure in the presence of palladium. The catalyst was removed and the product crystallized when the filtrate was cooled. The substance formed white needles which melted at 175–176° (dec.).

Anal. Calcd. for $C_{13}H_{16}O_4$: C, 66.10; H, 6.78. Found: C, 66.16; H, 7.09.

Decarboxylation of this acid gave IV, m. p. and mixed m. p. 142.5°.

2,3,4-Trimethylcinnamic Acid (X).—The aldehyde IX (2 g.), malonic acid (1.3 g.) and piperidine (5 drops) were heated on the steam-bath overnight in a flask equipped with a drying tube. The reaction mixture was taken up in dilute sodium carbonate solution and the solution was extracted with ether. The carbonate layer was divided into two equal portions. Acidification of one portion produced the cinnamic acid X. When crystallized from dilute acetic acid, the product was white and melted at 207–208°. The yield was excellent.

Anal. Calcd. for $C_{12}H_{14}O_2$: C, 75.70; H, 7.36. Found: C, 75.85; H, 7.65.

The other portion of the carbonate solution was shaken for an hour with sodium amalgam (0.75 g. sodium in 25 g. mercury) and then heated on the steam-bath for three hours. The mixture was filtered and the clear filtrate, when acidified, deposited a white solid. This was the acid IV; when crystallized from alcohol it melted at 142–143.5°.

Synthesis of 2,3,4,5-Tetramethylphenylacetic Acid VI.[8]—The route to this acid was as follows: (R = 2,3,4,5-tetramethylphenyl)

$$\underset{\text{XIV}}{\text{RCHO}} \longrightarrow \underset{\text{XV}}{\text{RCH}_2\text{OH}} \longrightarrow \underset{\text{XVI}}{\text{RCH}_2\text{Cl}} \longrightarrow$$

$$\underset{\text{XVII}}{\text{RCH}_2\text{CN}} \longrightarrow \underset{\text{VI}}{\text{RCH}_2\text{COOH}}$$

2,3,4,5-Tetramethylbenzaldehyde (XIV) was prepared from prehnitene (26.8 g.) zinc cyanide (50 g.) in benzene (100 cc., thiophene free) by the action of hydrogen chloride and aluminum chloride, essentially in the same manner as IX was prepared. The reaction product after decomposition with water was steam distilled and from the distillate after removal of the benzene there was obtained 34 g. of a yellow oil. This oil was taken up in ether and extracted twice with small portions of sodium carbonate, which removed 1.5 g. of 2,3,4,5-tetramethylbenzoic acid, m. p. 164–165°. From the ether there was isolated 29 g. (89%) of the aldehyde, which boiled at 142–144° under 15 mm. and melted at 29–30°. The aldehyde is extraordinarily sensitive to autoöxidation. The semicarbazone melted at 221–222°, and the oxime at 152.5–153.5°. The latter was analyzed.

Anal. Calcd. for $C_{11}H_{15}ON$: C, 74.5; H, 8.47. Found: C, 74.2; H, 8.10.

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[7] Smith and Moyle, THIS JOURNAL, **58**, 1 (1936).

[8] The synthesis of VI was carried out in 1934 by Mr. P. O. Tawney; see ref. 4.

2,3,4,5-Tetramethylbenzyl Alcohol (XV).—The aldehyde (15 g.) was reduced by refluxing it for twelve hours in acetic acid (100 cc.) and water (30 cc.) with zinc dust (4 g.). During this time fresh zinc dust was added every two hours in 2-g. portions. The mixture was cooled and poured into water, which precipitated a mixture of the alcohol and its acetate. The oil was taken up in ether, washed with carbonate, dried and the solvent evaporated. There remained 15 g. of a mixture of the alcohol and acetate. A portion of this (2.5 g.) was refluxed for three hours with 20% sodium hydroxide solution (60 cc.). The solution was cooled, acidified with dilute sulfuric acid, extracted with ether and the ether layer was dried. Removal of the ether left an oil which solidified on cooling. After crystallization from petroleum ether, the substance (0.9 g.) was white and melted at 80–81°.

Anal. Calcd. for $C_{11}H_{16}O$: C, 80.5; H, 9.75. Found: C, 80.6; H, 10.02.

2,3,4,5-Tetramethylbenzyl Chloride (XVI).—The crude mixture of alcohol and acetate (12.5 g.) was refluxed for six hours with concd. hydrochloric acid (215 cc.) and then allowed to stand overnight. The reaction mixture was poured into water and the oil was removed by extraction with ether. The ethereal solution was washed with dilute carbonate, then with water, and was dried. Removal of the ether left an oil which distilled at 139–140° under 15 mm. The yield was 6 g., while 3 g. of undistillable residue remained in the flask. The chloride solidified on cooling and after crystallization from alcohol, it melted at 44–45°.

Anal. Calcd. for $C_{11}H_{15}Cl$: C, 72.4; H, 8.28. Found: C, 72.8; H, 8.34.

2,3,4,5-Tetramethylbenzyl Cyanide (XVII).—The chloride (2 g.) in alcohol (15 cc.) was added to a boiling solution of sodium cyanide (0.89 g.) in water (2 cc.). The mixture was refluxed for three hours, then filtered and the alcohol was removed from the filtrate under reduced pressure. The brown solid was removed and crystallized twice from 50% alcohol (charcoal). The yield was 1 g., and the white plates melted at 57–58°.

Anal. Calcd. for $C_{12}H_{15}N$: C, 83.2; H, 8.67. Found: C, 83.17; H, 8.12.

2,3,4,5-Tetramethylphenylacetic Acid (VI).—The nitrile (0.2 g.) was refluxed for one hour with 25% sulfuric acid (10 cc.). The mixture was poured into water, and the solid was removed and crystallized twice from dilute alcohol. It formed fine, colorless needles which melted at 159–160° and it was identical with the acid VI obtained by action of hydrobromic acid upon the product obtained from prehnitene and ethyl diazoacetate, as shown by the mixed melting point.

Anal. Calcd for $C_{12}H_{16}O_2$: C, 75.00; H, 8.33. Found: C, 74.71; H, 8.28.

Claus and Föhlisch,[9] who synthesized this acid by oxidation of acetoprehnitene followed by reduction (hydriodic acid) of the α keto acid, reported that it melted at 125°, but these authors must have had a very impure specimen in hand.

Summary

1. When prehnitene and ethyl diazoacetate react at 140°, the product consists of a mixture of 2,3,4-trimethyldihydrocinnamic acid and 3,4,5,6-tetramethyl-Δ-1,3,6-cycloheptatrienecarboxylic acid..
2. The cycloheptatriene acid rearranges into 2,3,4,5-tetramethylphenylacetic acid when subjected to the action of hydrobromic acid in acetic acid.
3. The condensation was carried out in various ways in the attempt to detect or isolate norcaradiene and indazoline derivatives, the supposed primary products, but without success.
4. The structure of the trimethylhydrocinnamic acid and that of the tetramethylphenylacetic acid were proved by independent syntheses.

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(9) Claus and Föhlisch, *J. prakt. Chem.*, [2] 38, 230 (1888).

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[CONTRIBUTION FROM THE SCHOOL OF CHEMISTRY OF THE UNIVERSITY OF MINNESOTA]

Side Chain Bromination of Prehnitene and Some 2,3,6-Trimethylphenyl Derivatives[1]

BY LEE IRVIN SMITH AND COURTLAND L. AGRE

In the previous paper, the synthesis of 2,3,4-trimethyldihydrocinnamic acid was described. It was planned originally to synthesize this acid by starting with prehnitene (1,2,3,4-tetramethylbenzene) and converting the hydrocarbon into 2,3,4-trimethylbenzyl bromide by direct bromination at an elevated temperature in sunlight. Although a fair yield of a trimethylbenzyl bromide was obtained, the subsequent transformations of the substance showed that the methyl groups were not in positions 2, 3 and 4, but were in positions 2, 3 and 6. This interesting bromination of an interior methyl group in prehnitene makes readily accessible many 2,3,6-trimethylbenzyl derivatives in good yields, a number of which are described in the experimental part of this paper together with the proof of the orientation of the methyl groups. The compounds prepared, and

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(1) Polymethylbenzenes. XXI. Paper XX, THIS JOURNAL, 60, 648 (1938).